GEOTECHNOLOGY, INC.
ENGINEERING AND ENVIRONMENTAL SERVICES
SAINT LOUIS • COLLINSVILLE • KANSAS CITY

June 2, 2003

Mr. Jake Owen
U.S. Army Corps of Engineers
EC-GD, Room 824
601 East 12th Street
Kansas City, MO 64106-2896

Reference: Indefinite Delivery Contract No. DACA41-03-D-0003

Dear Mr. Owen:

Please find attached laboratory testing results for the McConnell AFB project under the referenced contract. We appreciate the continued opportunity to provide services to the Corps under this contract. Please feel free to call with any questions.

Very truly yours,

Geotechnology, Inc.

William C. Jones, P.E.
Division Manager

WCJ:wcj

Copies submitted: (1)

Attachments: McConnell AFB Laboratory Testing Results
EPA Standard 300.0



9136 COOY • OVERLAND PARK, KANSAS 66214 • 913/438-1900 • FAX: 913/438-1923

## LABORATORY TESTING RESULTS

### McConnell Air Force Base

| Boring No. | Sample No. | Depth (ft) | | Water Content (%) | Atterberg Limits | | | USC/Soil Group | Compression Test | | | Dry Unit Weight (pcf) | Total Sulphates mg/Kg | Soil pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From | To | | LL | PL | PI | | Test Type | Unconfined Compression Strength (tsf) | Failure Strain (%) | | | |
| ADU-3-1 | S-1 | | | 6.3 | 54 | 18 | 36 | CH | | | | | 29.9 | 7.72 |
| | J-1 | | | | | | | 15 | | | | | | |
| | J-2 | | | | | | | 16 | | | | | | |
| | J-3 | | | | | | | 1 | | | | | | |
| | J-4 | | | | | | | 1 | | | | | | |
| | J-5 | | | | | | | 2 | | | | | | |
| | J-6 | | | | | | | 2 | | | | | | |
| | J-7 | | | | | | | 17 | | | | | | |
| | | | | | | | | | | | | | | |
| ADU-3-2 | S-1 | | | 7.0 | 63 | 17 | 46 | CH | | | | | 20.7 | 8.16 |
| | J-1 | | | 25.3 | | | | 15 | | | | | | |
| | J-2 | | | 23.0 | | | | 4 | | | | | | |
| | J-3 | | | | | | | 1 | | | | | | |
| | J-4 | | | | | | | 5 | | | | | | |
| | J-5 | | | 29.7 | | | | 6 | | | | | | |
| | J-6 | | | | | | | 6 | | | | | | |
| | J-7 | | | | | | | 17 | | | | | | |
| | | | | | | | | | | | | | | |
| ADU-3-3 | S-1 | | | 7.5 | 63 | 21 | 42 | CH | | | | | 135 | 8.10 |
| | J-1 | | | | | | | 15 | | | | | | |
| | J-2 | | | | | | | 16 | | | | | | |
| | J-3 | | | 19.9 | | | | 7 | | | | | | |
| | J-4 | | | | | | | 7 | | | | | | |
| | J-5 | | | 28.6 | | | | 8 | | | | | | |
| | J-6 | | | | | | | 9 | | | | | | |
| | J-7 | | | 26.8 | | | | 9 | | | | | | |
| | | | | | | | | | | | | | | |
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## LABORATORY TESTING RESULTS

### McConnell Air Force Base

| Boring No. | Sample No. | Depth (ft) | | Water Content (%) | Atterberg Limits | | | USC/Soil Group | Compression Test | | | Dry Unit Weight (pcf) | Total Sulphates mg/Kg | Soil pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From | To | | LL | PL | PI | | Test Type | Unconfined Compression Strength (tsf) | Failure Strain (%) | | | |
| | S-1 | | | 8.8 | 71 | 22 | 49 | CH | | | | | 260 | 7.96 |
| | J-1 | | | | | | | 10 | | | | | | |
| | J-2 | | | | | | | 10 | | | | | | |
| | J-3 | | | | | | | 10 | | | | | | |
| ADU-3-4 | J-4 | | | | | | | 10 | | | | | | |
| | J-5 | | | | | | | 11 | | | | | | |
| | J-6 | | | | | | | 12 | | | | | | |
| | J-7 | | | | | | | 12 | | | | | | |
| | | | | | | | | | | | | | | |
| | S-1 | | | 7.4 | 65 | 20 | 45 | CH | | | | | 180 | 8.09 |
| | J-1 | | | | | | | 13 | | | | | | |
| | J-2 | | | 15.2 | | | | 13 | | | | | | |
| | J-3 | | | | | | | 13 | | | | | | |
| ADU-3-5 | J-4 | | | 18.2 | | | | 13 | | | | | | |
| | J-5 | | | | | | | 14 | | | | | | |
| | J-6 | | | 25.8 | | | | 14 | | | | | | |
| | J-7 | | | | | | | 14 | | | | | | |
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## LABORATORY TESTING RESULTS

**McConnell Air Force Base**

| Boring No. | Sample No. | Depth (ft) | | Water Content (%) | Atterberg Limits | | | USC/Soil Group | Compression Test | | | Dry Unit Weight (pcf) | Total Sulphates mg/Kg | Soil pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From | To | | LL | PL | PI | | Test Type | Unconfined Compression Strength (tsf) | Failure Strain (%) | | | |
| ADU-3-1 | Wax#1 | 7.0 | 8.9 | 22.1 | 57 | 21 | 36 | CH | Qu | 0.66 | 1.93 | 100.4 | | |
| | Wax#2 | 12.0 | 13.9 | 29.1 | 84 | 27 | 57 | CH | | | | 90.5 | | |
| | Wax#3 | 17.0 | 18.9 | 30.4 | 49 | 23 | 26 | CL | | | | | | |
| | | | | | | | | | | | | | | |
| ADU-3-2 | Wax#1 | 7.0 | 8.9 | 21.2 | 59 | 18 | 41 | CH | | | | | | |
| | Wax#2 | 12.0 | 13.9 | 25.8 | 72 | 20 | 52 | CH | Qu | 1.29 | 1.60 | 98.1 | | |
| | Wax#3 | 17.0 | 17.9 | 30.6 | 70 | 30 | 40 | CH | | | | | | |
| | | | | | | | | | | | | | | |
| ADU-3-3 | Wax#1 | 7.0 | 8.9 | 18.7 | 55 | 15 | 40 | CH | Qu | 0.48 | 3.55 | 104.4 | | |
| | Wax#2 | 12.0 | 13.9 | 26.2 | 69 | 20 | 49 | CH | | | | 96.8 | | |
| | Wax#3 | 17.0 | 18.9 | 25.7 | 58 | 25 | 33 | CH | | | | | | |
| | | | | | | | | | | | | | | |
| ADU-3-4 | Wax#1 | 7.0 | 8.9 | 20.9 | 39 | 16 | 23 | CL | | | | | | |
| | Wax#2 | 12.0 | 13.9 | 11.1 | 41 | 19 | 22 | CL | Qu | 0.73 | 4.75 | 113.6 | | |
| | Wax#3 | 17.0 | 18.3 | 31.2 | 73 | 28 | 45 | CH | | | | | | |
| | | | | | | | | | | | | | | |
| ADU-3-5 | Wax#1 | 7.0 | 8.9 | 18.5 | 40 | 16 | 24 | CL | Qu | 0.94 | 3.10 | 104.2 | | |
| | Wax#2 | 12.0 | 13.9 | 24.1 | 65 | 25 | 40 | CH | Qu | 1.66 | 4.26 | 102.4 | | |
| | Wax#3 | No Sample | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
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**SUMMARY OF CLASSIFICATIONS TESTS**

***Project: McConnel AFB***

Note: By visual examination and classification, samples not tested were compared and grouped with typical test samples described below:

| | | |
|---|---|---|
| 1) | Fat Clay (CH) | Brown, trace silt, Fe staining, slightly blocky structure, ADU 03-01 Wax # 1 (LL-57, PI-36) |
| 2) | Fat Clay (CH) | Olive, shaley, occasional rock fragments, ADU 03-01 Wax # 2 (LL-84, PI-57) |
| 3) | Lean Clay (CL) | Brown & gray, trace highly weathered sandstone, ADU 03-01 Wax # 3 (LL-49, PI-26) |
| 4) | Fat Clay (CH) | Brown & gray, trace highly weathered siltstone, trace FeO stain, trace gravel, ADU 03-02 Wax # 1 (LL-59, PI-41) |
| 5) | Fat Clay (CH) | Brown & olive brown, trace gravel and highly weathered rock (trace glass, fill?), ADU 03-02 Wax # 2 (LL-72, PI-52) |
| 6) | Fat Clay (CH) | Olive brown, trace highly weathered clayey shale and gravel, ADU 03-02 Wax # 3 (LL-70, PI-40) |
| 7) | Fat Clay (CH) | Pale brown, trace silt, blocky structure, ADU 03-03 Wax # 1 (LL-55, PI-40) |
| 8) | Fat Clay (CH) | Olive brown & gray, highly weathered rock, trace gravel, ADU 03-03 Wax # 2 (LL-69, PI-49) |
| 9) | Fat Clay (CH) | Olive brown, trace highly weathered clayey shale and gravel, ADU 03-03 Wax # 3 (LL-58, PI-33) |

**SUMMARY OF CLASSIFICATIONS TESTS**

***Project: McConnel AFB***

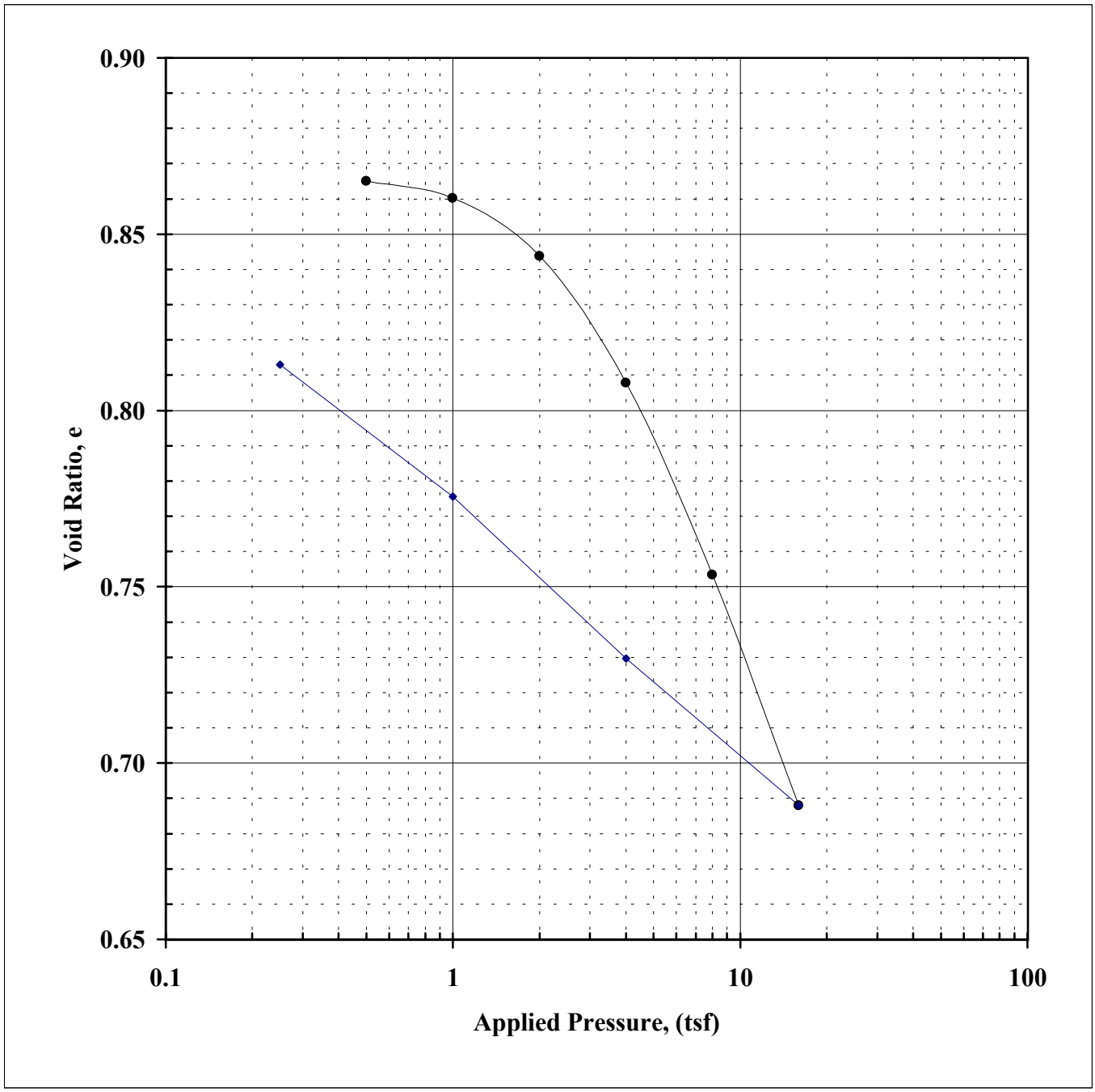
| | | |
|---|---|---|
| 10) | Lean Clay (CL) | Reddish brown, trace highly weathered siltstone, trace FeO, ADU 03-04 Wax # 1 (LL-39, PI-23) |
| 11) | Lean Clay (CL) | Brown & olive brown clay or clayey sand, trace gravel, ADU 03-04 Wax # 2 (LL-41, PI-22) |
| 12) | Fat Clay (CH) | Olive brown, trace highly weathered rock, ADU 03-04 Wax # 3 (LL-73, PI-45) |
| 13) | Lean Clay (CL) | Reddish brown, trace sand and highly weathered sandstone in fat clay matrix with Fe stains, ADU 03-05 Wax # 1 (LL-40, PI-24) |
| 14) | Fat Clay (CH) | Olive clay, with shaley zone, rock fragments, ADU 03-05 Wax # 2 (LL-65, PI-40) |
| 15) | Lean Clay (CL) | Dark grayish brown, trace silt, fine to medium sand |
| 16) | Fat Clay (CH) | Brownish gray, trace silt, small rock fragments |
| 17) | Lean Clay (CL) | Olive, severely to moderately weathered shale, trace silt, blocky structure |

| | | | | | |
|---|---|---|---|---|---|
| Boring No. | ADU-3-1 | **GEOTECHNOLOGY** | Job No. | 0680801.3213 |
| Sample No. | Wax-2 | ENGINEERING AND ENVIRONMENTAL SERVICES | Job Name | COE - McConnel |
| Depth (ft) | 12 | SAINT LOUIS, MISSOURI | Sheet No. | |
| Tested By | ARK | **One-Dimensional Consolidation Test** | Test Date | 05/08/03 |
| Computed By | yaw | **(ASTM D 4546-96-C)** | Checked By | |

**Plot of Void Ratio versus Log of Pressure**

**Compression Index, $C_c$ =** 0.210 **Void Ratio, $e_o$ =** 0.861

**Recompression Index, $C_r$ =** 0.069 **Preconsolidation Pressure =** 3.1 **(tsf)**

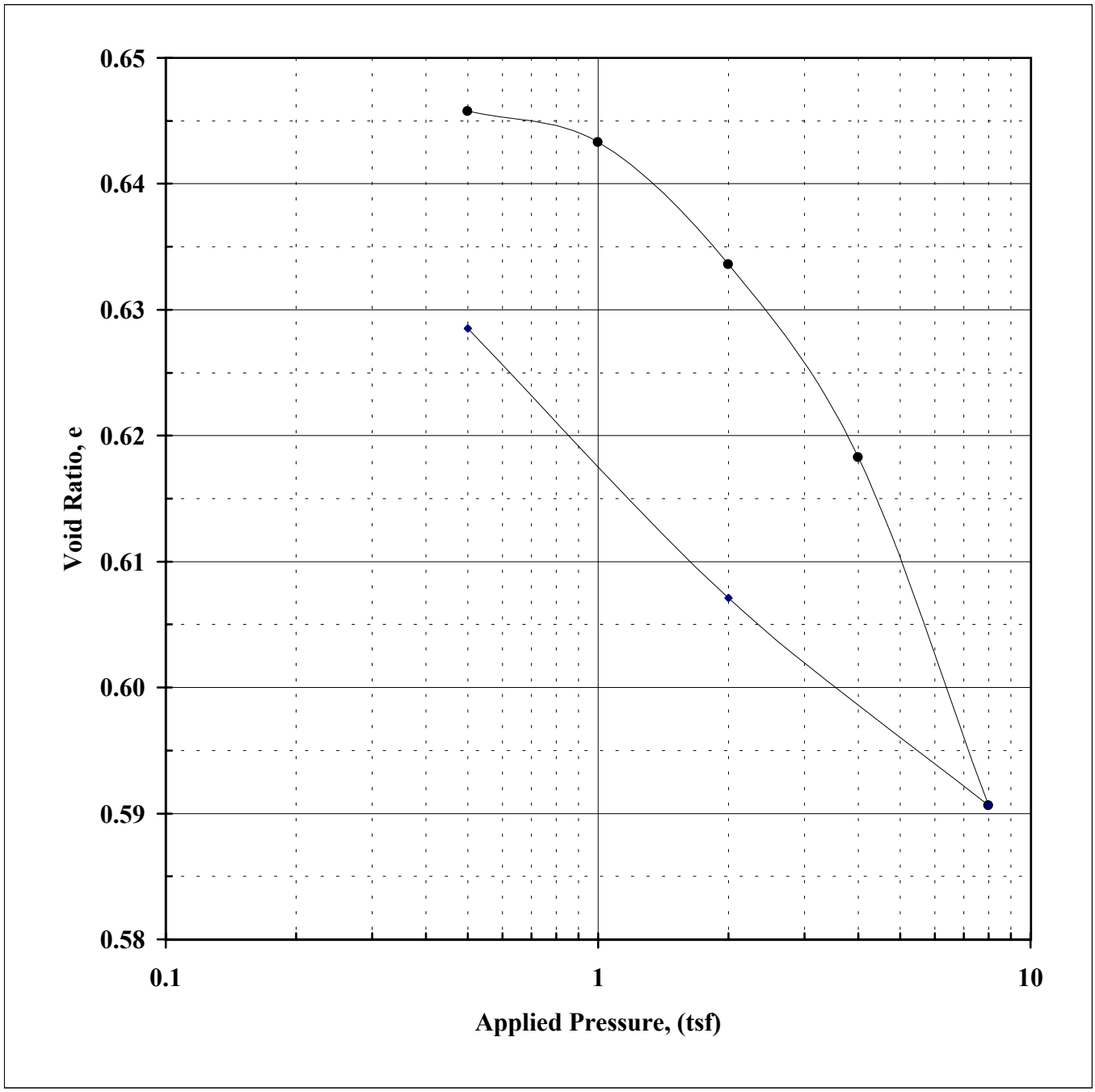


| | | | | | |
|---|---|---|---|---|---|
| Boring No. | ADU-3-5 | **GEOTECHNOLOGY** | Job No. | 0680801.3213 |
| Sample No. | Wax-2 | ENGINEERING AND ENVIRONMENTAL SERVICES | Job Name | COE - McConnel |
| Depth (ft) | 12 | SAINT LOUIS, MISSOURI | Sheet No. | |
| Tested By | ARK | **One-Dimensional Consolidation Test** | Test Date | 5/21/03 |
| Computed By | ARK | **(ASTM D 4546-96-C)** | Checked By | |

**Plot of Void Ratio versus Log of Pressure**

**Compression Index, $C_c$ =** 0.096 **Void Ratio, $e_o$ =** 0.645

**Recompression Index, $C_r$ =** 0.028 **Preconsolidation Pressure =** 2.4 **(tsf)**

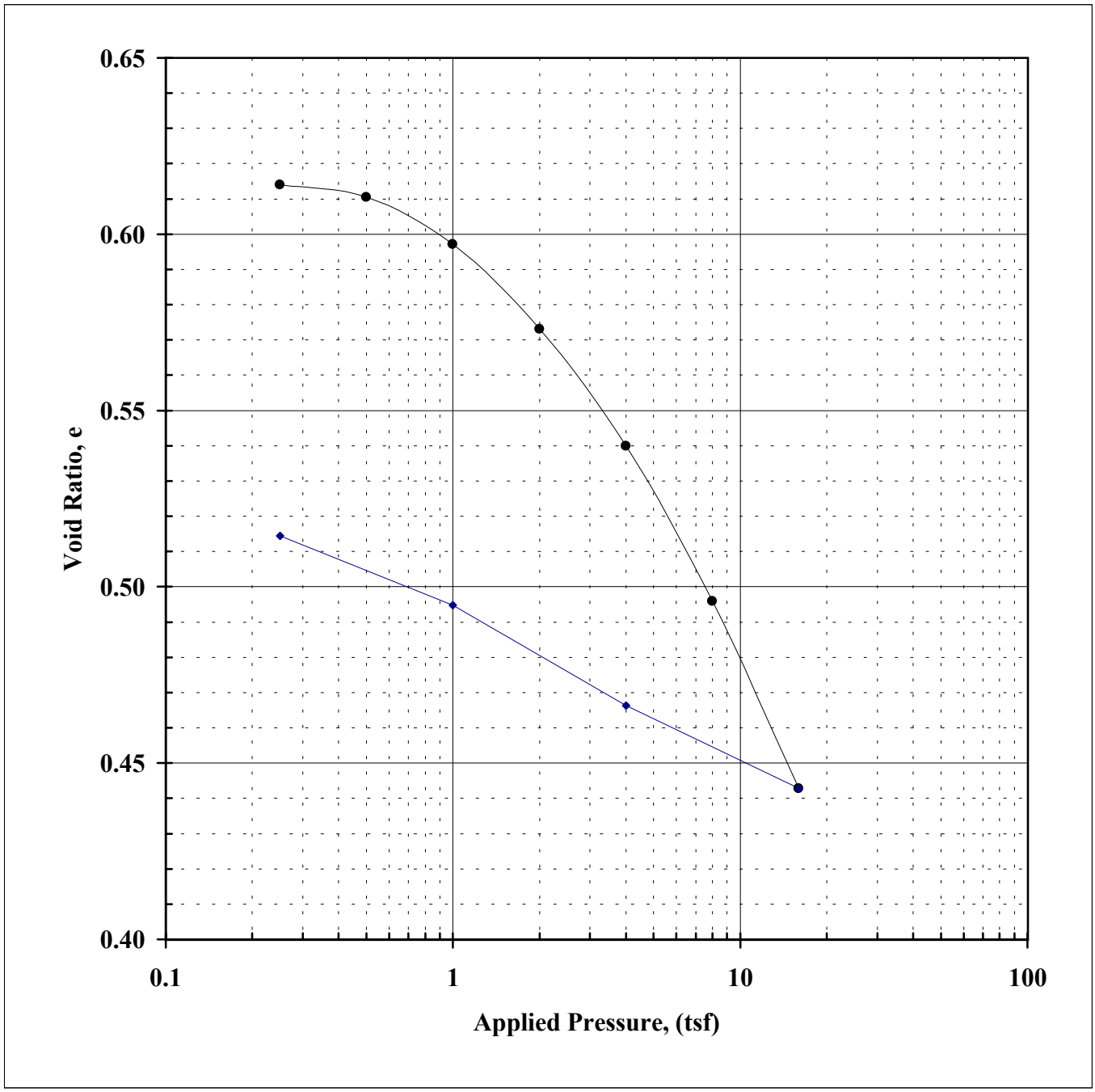


| | | | | | |
|---|---|---|---|---|---|
| Boring No. | ADU-3-3 | **GEOTECHNOLOGY** | | Job No. | 0680801.3213 |
| Sample No. | Wax-1 | ENGINEERING AND ENVIRONMENTAL SERVICES | | Job Name | COE - McConnel |
| Depth (ft) | 8-9 | SAINT LOUIS, MISSOURI | | Sheet No. | |
| Tested By | ARK | **One-Dimensional Consolidation Test** | | Test Date | 05/08/03 |
| Computed By | yaw | **(ASTM D 4546-96-C)** | | Checked By | |

**Plot of Void Ratio versus Log of Pressure**

**Compression Index, $C_c$ =** 0.169 **Void Ratio, $e_o$ =** 0.614

**Recompression Index, $C_r$ =** 0.040 **Preconsolidation Pressure =** 2.3 **(tsf)**



| | | | | | |
|---|---|---|---|---|---|
| Boring No. | ADU-3-3 | | | Job No. | 0680801.3213 |
| Sample No. | Wax-2 | | | Job Name | COE - McConnel |
| Depth (ft) | 12 | | | Sheet No. | |
| Tested By | ARK | | | Test Date | 5/21/03 |
| Computed By | ARK | | | Checked By | |

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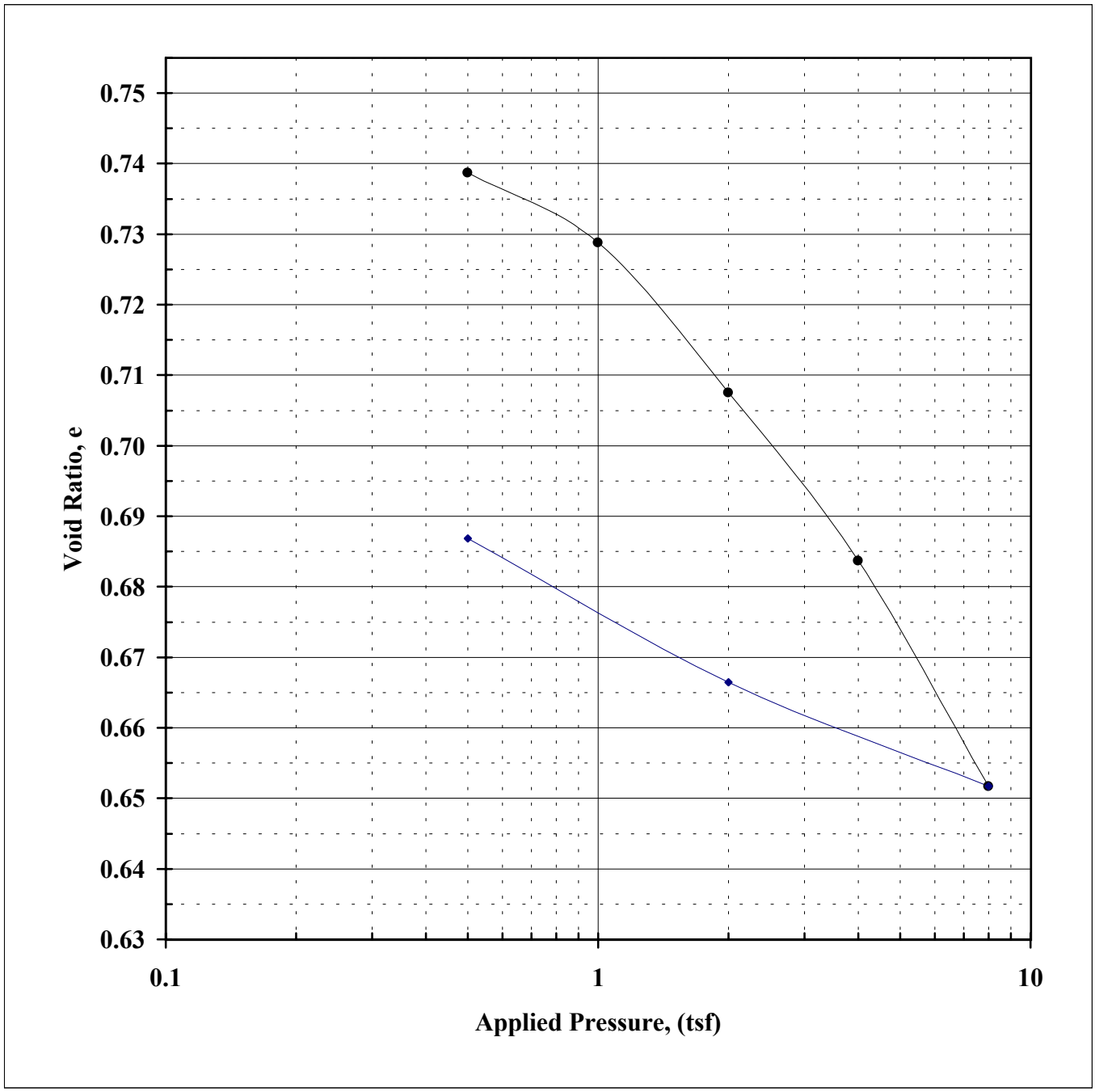
## One-Dimensional Consolidation Test

**(ASTM D 4546-96-C)**

**Plot of Void Ratio versus Log of Pressure**

| | | | |
|---|---|---|---|
| **Compression Index, $C_c$ =** | 0.105 | **Void Ratio, $e_o$ =** | 0.74 |
| **Recompression Index, $C_r$ =** | 0.028 | **Preconsolidation Pressure =** | 1.75 **(tsf)** |



| | | | | | |
|---|---|---|---|---|---|
| Boring No. | ADU-3-1 | | | Job No. | 0680801.3213 |
| Sample No. | Wax-1 | | | Job Name | COE - McConnel |
| Depth (ft) | 8.7-8.9 | | | Sheet No. | |
| Tested By | ARK | | | Test Date | 05/08/03 |
| Computed By | yaw | | | Checked By | |

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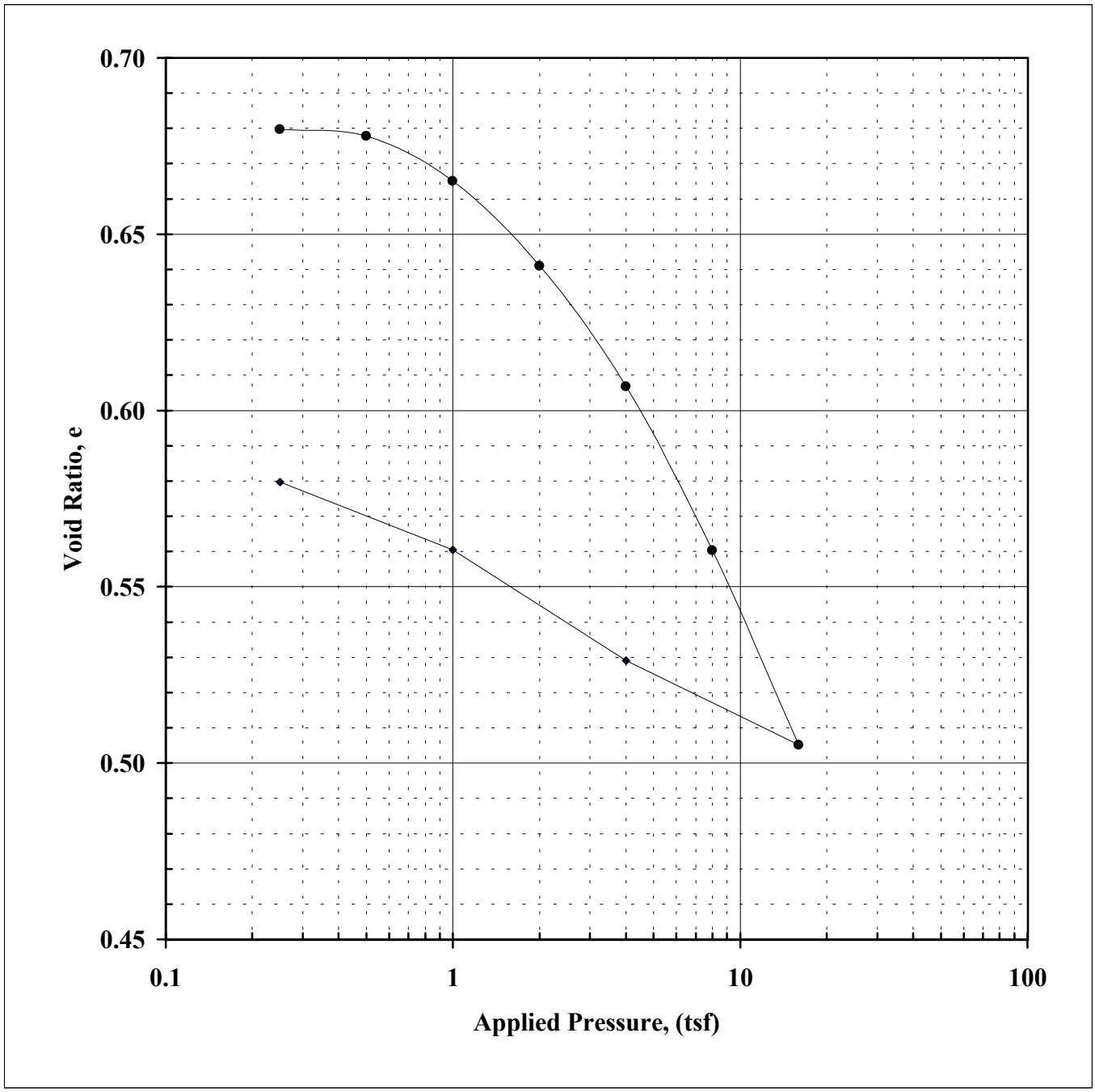
SAINT LOUIS, MISSOURI

## One-Dimensional Consolidation Test

**(ASTM D 4546-96-C)**

**Plot of Void Ratio versus Log of Pressure**

| | | | |
|---|---|---|---|
| **Compression Index, $C_c$ =** | 0.176 | **Void Ratio, $e_o$ =** | 0.678 |
| **Recompression Index, $C_r$ =** | 0.041 | **Preconsolidation Pressure =** | 2.6 **(tsf)** |

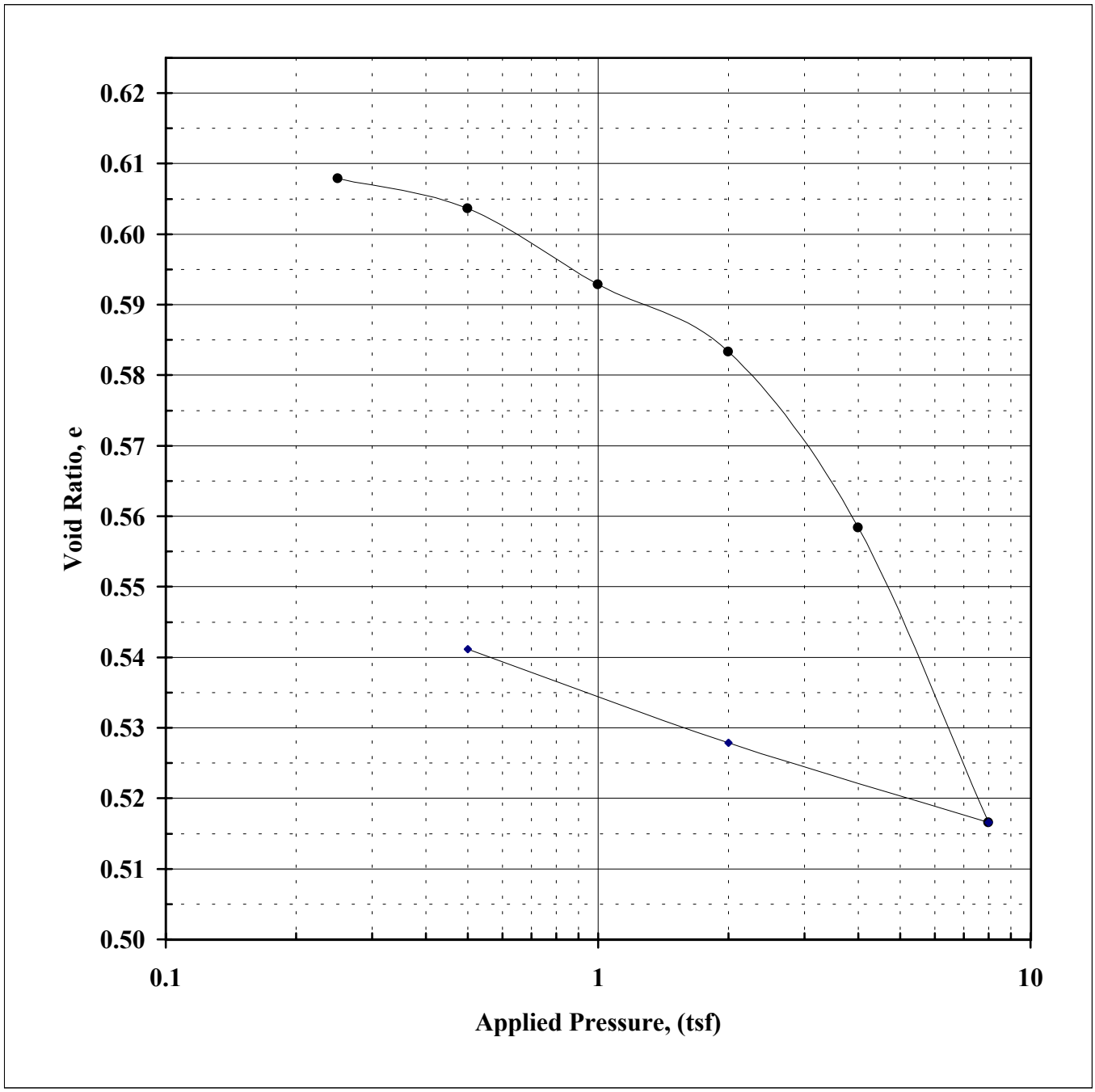


| | | | | | |
|---|---|---|---|---|---|
| Boring No. | ADU-3-5 | **GEOTECHNOLOGY** | Job No. | 0680801.3213 |
| Sample No. | Wax-1 | ENGINEERING AND ENVIRONMENTAL SERVICES | Job Name | COE - McConnel |
| Depth (ft) | 9 | SAINT LOUIS, MISSOURI | Sheet No. | |
| Tested By | ARK | **One-Dimensional Consolidation Test** | Test Date | 5/21/03 |
| Computed By | ARK | **(ASTM D 4546-96-C)** | Checked By | |

**Plot of Void Ratio versus Log of Pressure**

**Compression Index, $C_c$ =** 0.136 **Void Ratio, $e_o$ =** 0.616

**Recompression Index, $C_r$ =** 0.020 **Preconsolidation Pressure =** 2.8 **(tsf)**



| | | | |
|---|---|---|---|
| Boring No. | ADU-03-02 | Job No. | 0680801.3213 |
| Sample No. | Wax #2 | Job Name | COE - McConnell |
| Depth (ft) | 12 - 13.9' | Tested By | yaw |
| Date | 05/23/2003 | Calculated By | yaw |
| Sheet No. | | Checked By | |

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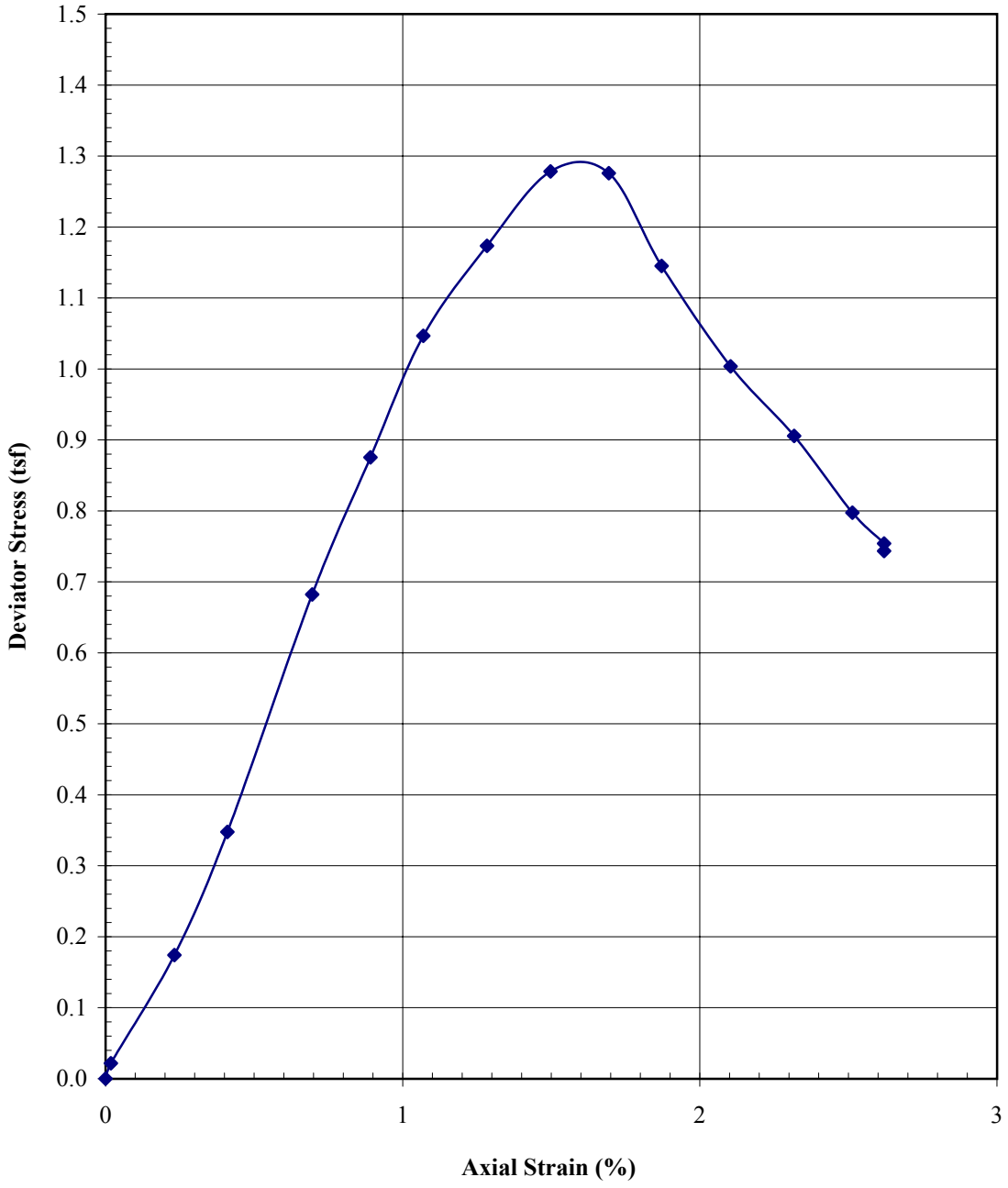
SAINT LOUIS, MISSOURI

**UNCONFINED COMPRESSION TEST**
**Stress-Strain Plot**

| | | | |
|---|---|---|---|
| Max. Shear Strength = | 1.29 tsf | Water Content = | 25.8 % |
| Failure Strain = | 1.60 % | Dry Unit Weight = | 98.1 pcf |



| | | | |
|---|---|---|---|
| Boring No. | ADU-03-05 | Job No. | 0682901.3211 |
| Sample No. | Wax#2 | Job Name | McConnell AFB |
| Depth (ft) | 12' - 13.9' | Tested By | yaw |
| Date | 05/21/2003 | Calculated By | yaw |
| Sheet No. | | Checked By | |

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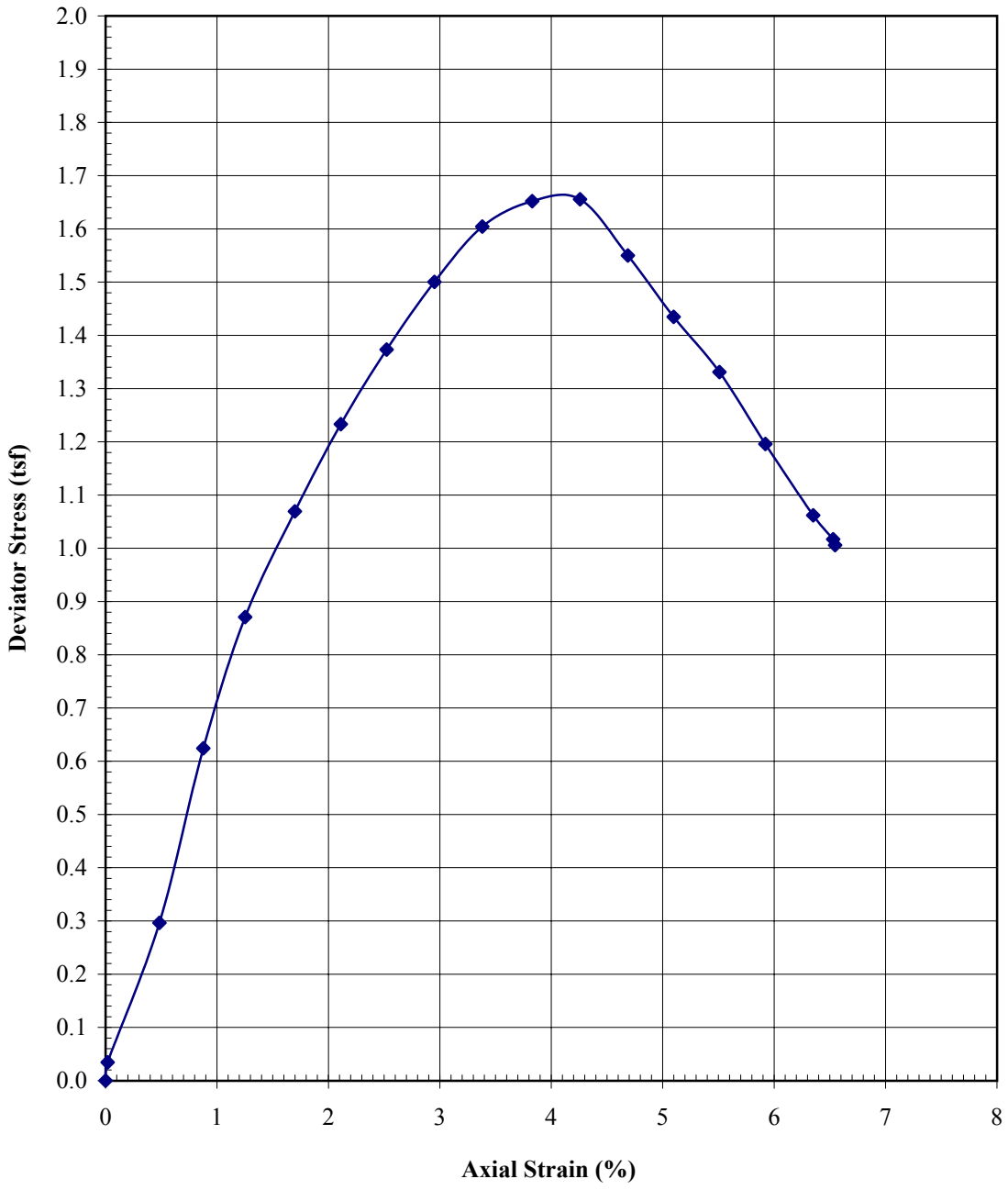
**UNCONFINED COMPRESSION TEST**
**Stress-Strain Plot**

| | | | |
|---|---|---|---|
| Max. Shear Strength = | 1.66 tsf | Water Content = | 24.1 % |
| Failure Strain = | 4.26 % | Dry Unit Weight = | 99.8 pcf |



| | | | |
|---|---|---|---|
| Boring No. | ADU-03-05 | Job No. | 06808 |
| Sample No. | Wax#1 | Job Name | McConnell AFB |
| Depth (ft) | 7' - 8.9' | Tested By | yaw |
| Date | 05/21/2003 | Calculated By | yaw |
| Sheet No. | | Checked By | |

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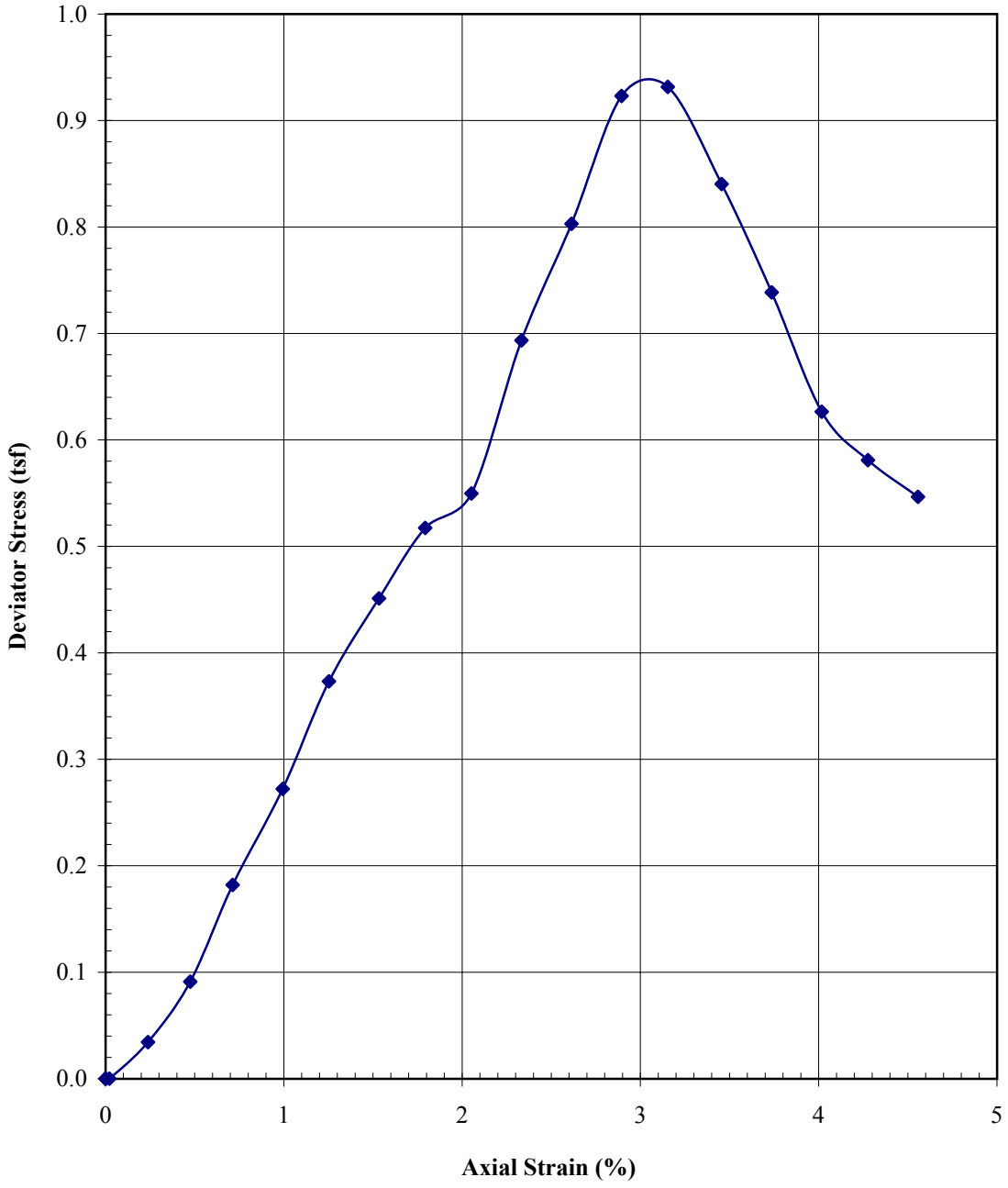
**UNCONFINED COMPRESSION TEST**
**Stress-Strain Plot**

| | | | |
|---|---|---|---|
| Max. Shear Strength = | 0.94 tsf | Water Content = | 18.5 % |
| Failure Strain = | 3.10 % | Dry Unit Weight = | 107.7 pcf |



| | |
|---|---|
| Boring No. | ADU-03-04 |
| Sample No. | Wax #2 |
| Depth (ft) | 12 - 13.9' |
| Date | 05/23/2003 |
| Sheet No. | |

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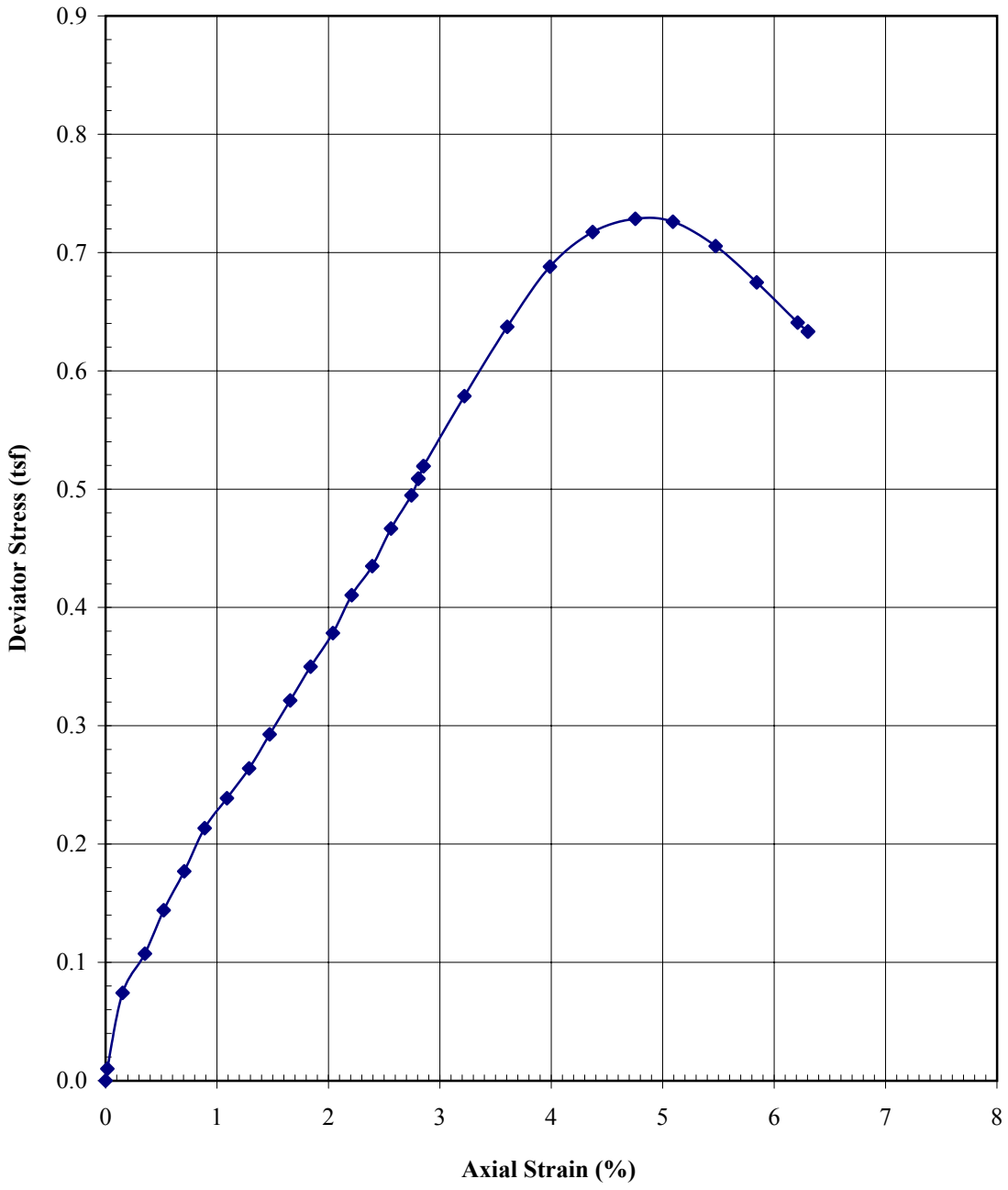
ENGINEERING AND ENVIRONMENTAL SERVICES
SAINT LOUIS, MISSOURI

## UNCONFINED COMPRESSION TEST
### Stress-Strain Plot

| | |
|---|---|
| Job No. | 0680801.3213 |
| Job Name | COE - McConnell |
| Tested By | yaw |
| Calculated By | yaw |
| Checked By | |

| | | | |
|---|---|---|---|
| Max. Shear Strength = | 0.73 tsf | Water Content = | 11.1 % |
| Failure Strain = | 4.75 % | Dry Unit Weight = | 113.6 pcf |



| | | | |
|---|---|---|---|
| Boring No. | ADU-03-03 | Job No. | 0680801.3213 |
| Sample No. | Wax #1 | Job Name | COE - McConnell |
| Depth (ft) | 7 - 8.9' | Tested By | yaw |
| Date | 05/23/2003 | Calculated By | yaw |
| Sheet No. | | Checked By | |

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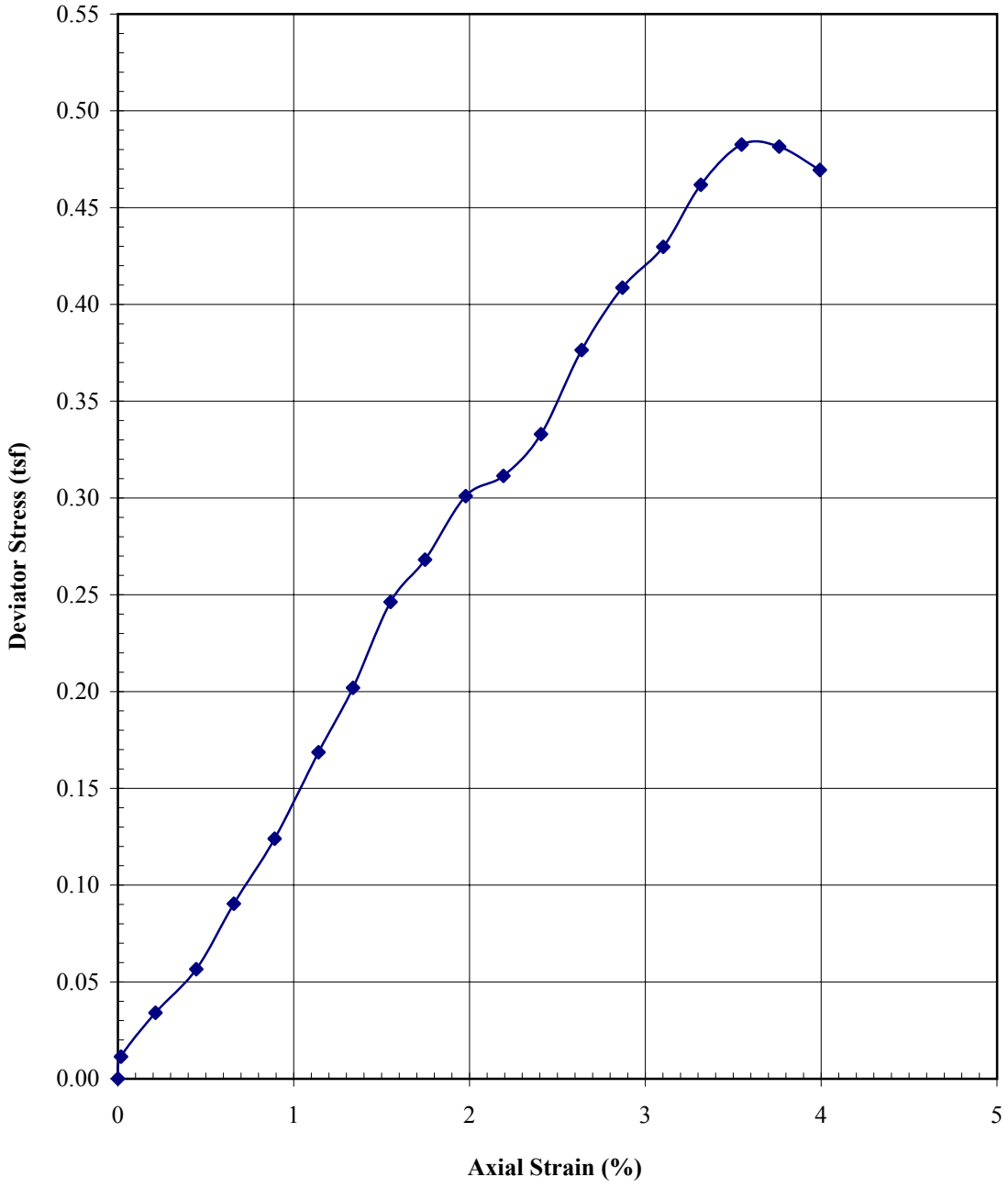
**UNCONFINED COMPRESSION TEST**
**Stress-Strain Plot**

| | | | |
|---|---|---|---|
| Max. Shear Strength = | 0.48 tsf | Water Content = | 18.7 % |
| Failure Strain = | 3.55 % | Dry Unit Weight = | 102.4 pcf |



| | | | |
|---|---|---|---|
| Boring No. | ADU-03-01 | Job No. | 0680801.3213 |
| Sample No. | Wax #1 | Job Name | COE - McConnell |
| Depth (ft) | 7 - 8.9' | Tested By | yaw |
| Date | 05/23/2003 | Calculated By | yaw |
| Sheet No. | | Checked By | |

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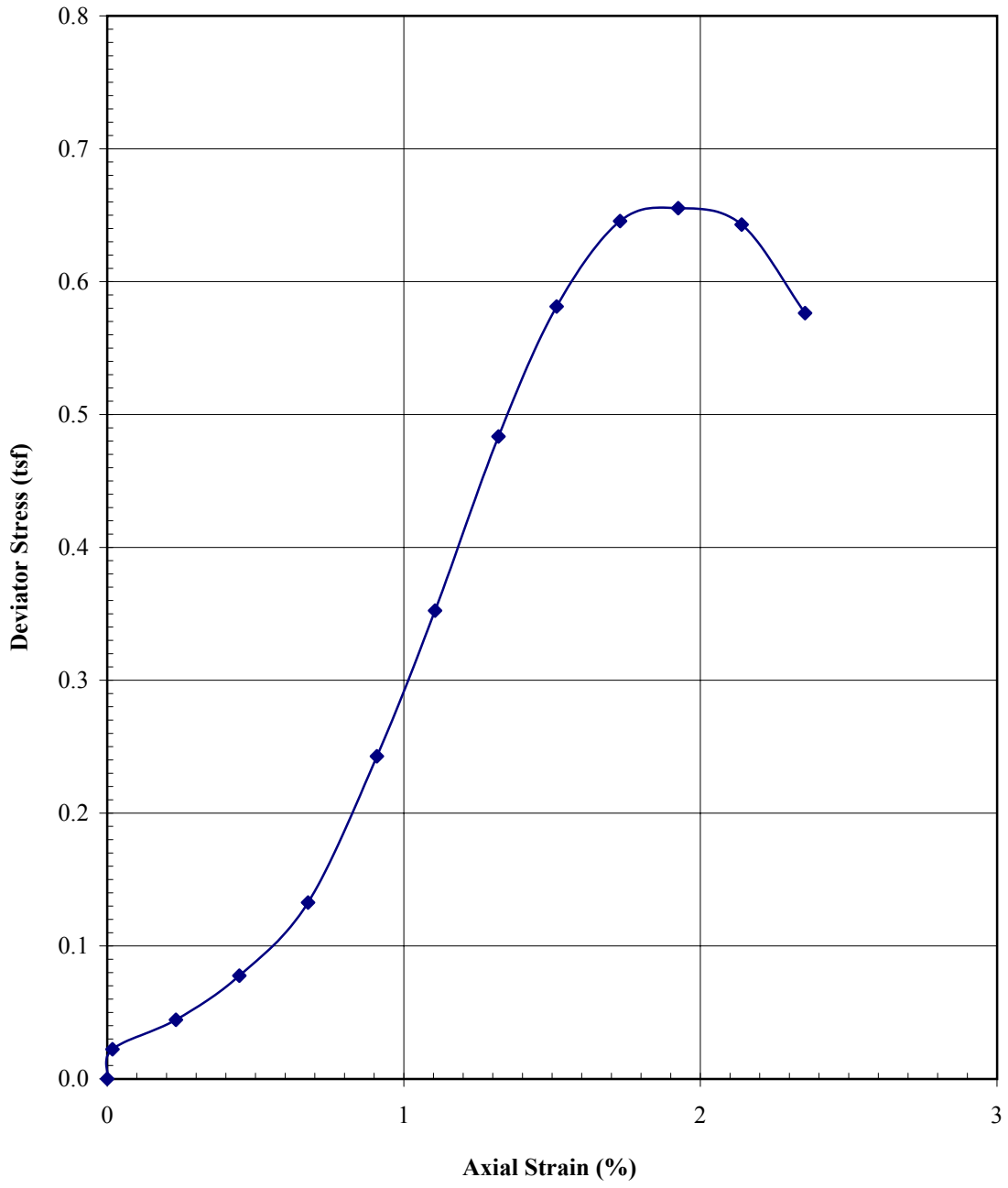
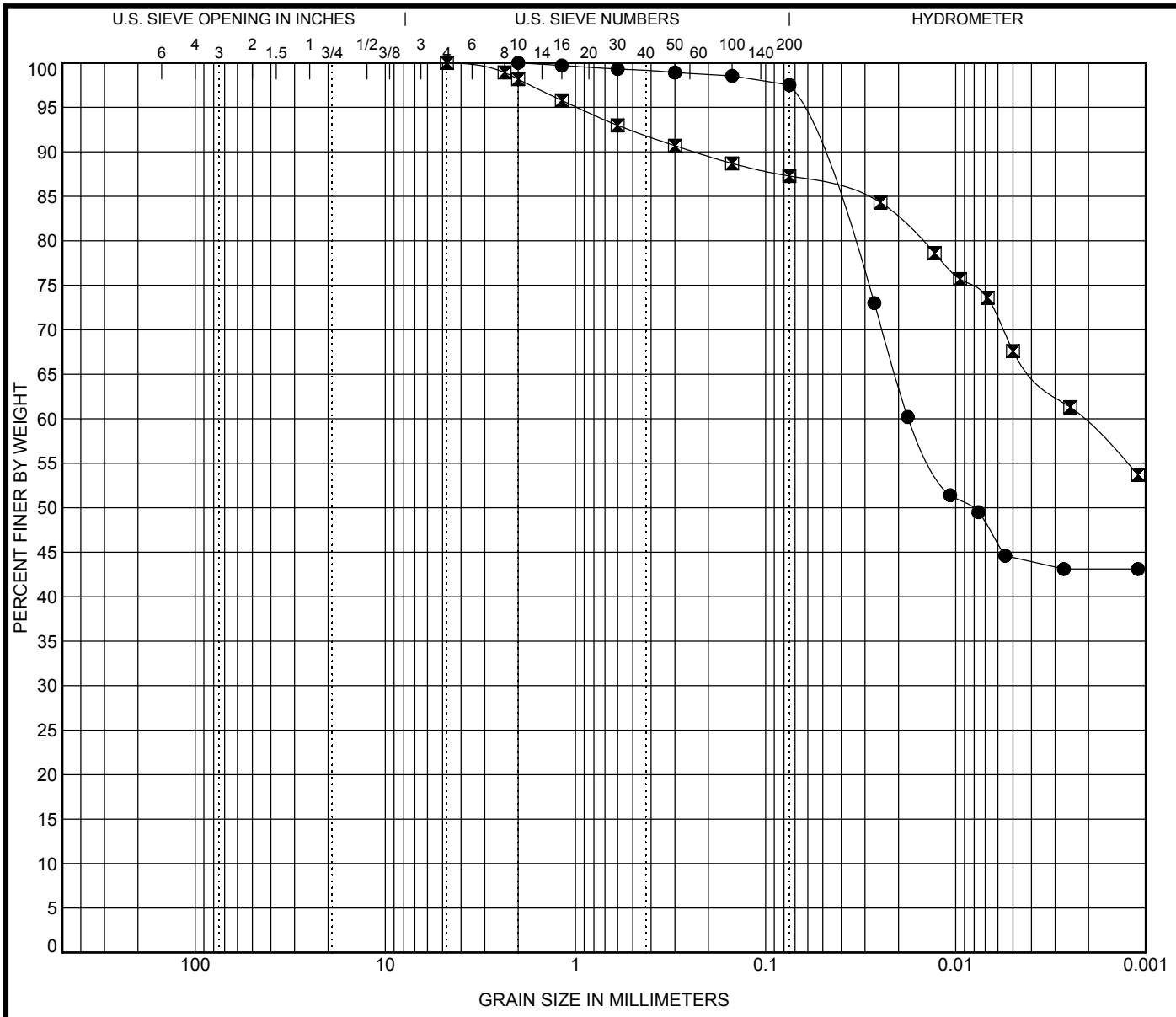
**UNCONFINED COMPRESSION TEST**
**Stress-Strain Plot**

| | | | |
|---|---|---|---|
| Max. Shear Strength = | 0.66 tsf | Water Content = | 22.1 % |
| Failure Strain = | 1.93 % | Dry Unit Weight = | 97.1 pcf |






| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | **ADU-03-02** | **5.0** | **See Log of Boring** | **63** | **21** | **42** | | |
| ⊠ | **ADU-03-05** | **15.0** | **See Log of Boring** | **65** | **20** | **45** | | |

| | Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | **ADU-03-02** | **5.0** | **2** | **0.018** | | | **0.0** | **2.5** | **53.1** | **44.4** |
| ⊠ | **ADU-03-05** | **15.0** | **4.75** | **0.002** | | | **0.0** | **12.7** | **19.7** | **67.6** |

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